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Aeromagnetic survey program of the Geological Survey of Canada, 2001–2002

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Abstract: In 2001, the Geological Survey of Canada supervised six aeromagnetic survey contracts totalling 391 873 line-kilometres. These surveys were flown in British Columbia, Northwest Territories, Nunavut, Quebec, and New Brunswick. In addition, the recompilation of private-sector airborne-geophysical survey data sets were completed for northern Ontario and Newfoundland. A helicopter-borne electromagnetic/magnetic survey for groundwater detection in northeastern Brazil was jointly supervised by the GSC and Servico Geologico do Brasil.

Résumé : En 2001, la Commission géologique du Canada a assuré la supervision de six levés aéromagnétiques réalisés à contrat qui ont couvert une distance linéaire de plus de 391 873 kilomètres. Ces levés ont été exécutés en Colombie-Britannique, dans les Territoires du Nord-Ouest, au Nunavut, au Québec et au Nouveau-Brunswick. On en outre complété la compilation de jeux de données de levés géophysiques aériens exécutés par le secteur privé dans le nord de l'Ontario et à Terre-Neuve. Un levé électromagnétique et magnétique par hélicoptère réalisé aux fins de recherche d'eau souterraine dans le nord-est du Brésil a été supervisé conjointement par la CGC et le Servico Geologico do Brasil.

INTRODUCTION

In 2001, the GSC aeromagnetic program included a survey over the Mackenzie Corridor of the Northwest Territories, continuing a multiyear acquisition project, which commenced in 1998. In collaboration with the Ontario Geological Survey (OGS), a survey was carried out over the Wawa–Kapuskasing area of northern Ontario. Three surveys which were initiated in 2001 under the Targeted Geoscience Initiative (TGI) were completed. These surveys were located in British Columbia, Quebec, and Nunavut. Reprocessing of older industry data over the James Bay Lowlands area of northern Ontario was undertaken under a collaborative agreement with the OGS. A second reprocessing job for the TGI project to examine the 'Red Indian Line', through the Buchans mining district in Newfoundland, was also completed (Table 1). A new survey funded by the New Brunswick Department of Natural Resources and Energy will be flown in southern New Brunswick in 2002. Locations of these projects are shown in Figure 1, with accompanying details summarized in Table 2. A helicopter-borne electromagnetic/magnetic survey for groundwater detection in northeastern Brazil was jointly supervised by the GSC and Servico Geologico do Brasil.

NEW SURVEYS IN 2001

Northwest Territories

During the spring of 2001, the Geological Survey of Canada (GSC) continued with the fourth phase of the multiyear airborne magnetic survey over the Mackenzie Corridor region of the Northwest Territories. The survey was carried out over the Colville Lake area covering NTS 96 L, M and parts of 96 F, K and N. The purpose of this survey was to provide new geoscience data, as no publicly available magnetic-survey coverage exists. The magnetic-field patterns are indicative of the subsurface geological structure and will be used as an important element of geological mapping, resource exploration, and for siting seismic lines.

The cost of data acquisition was jointly funded by the GSC and four industry participants. The GSC was responsible for preparation of the survey contract, monitoring of survey operations, supervising the data compilation, and inspecting the final deliverables. Approximately 50 780 line-kilometres of new data were acquired.

The survey digital data is currently being processed and the results will be published by the GSC as eight colour aeromagnetic total-field magnetic maps at a scale of 1:100 000. All results will be released to the public in October 2002.

Ontario

During the winter of 2001, the GSC acquired airborne geophysical data over the Wawa–Kapuskasing area of northern Ontario (NTS 42 B). The survey was funded by Industry Canada's FedNor initiative. In collaboration with the Ontario Geological Survey, this area was identified as having high mineral potential in need of public geoscience data. It is expected that the results of this aeromagnetic survey will stimulate mineral exploration and lead to increased economic activity. The results will also complement a major initiative by the Province of Ontario, called Operation Treasure Hunt, which has acquired and published airborne geophysics in adjacent areas. Given the size of this project and the short time frame, the project was contracted to three firms: Goldak Exploration Technology Ltd. of Saskatoon, Sial Geosciences Inc. of St-Laurent, and Scintrex Ltd. of Concord. The survey results were jointly released with the Ontario Geological Survey on September 4, 2001. Open files 4029 to 4056 (Dumont et al.,

Table 1. Data reprocessing projects.

DATA REPROCESSING PROJECTS	LINE-KM
James Bay Lowland, Ontario	37 067
Red Indian Lake, Newfoundland	9479

Table 2. Total-field aeromagnetic surveys.

TOTAL-FIELD AEROMAGNETIC SURVEYS	LINE-KM	LINE SPACING	ELEVATION OF DRAPED SURFACE	YEAR OF PUBLICATION
Atlin, British Columbia	30 735	500 m	200 m	2001
Committee Bay, Nunavut	85 300	400 m	150 m	2001
Lac Vernon, Quebec	92 410	300 m	150 m	2001
Wawa–Kapuskasing Ontario	105 848	200 m	100 m	2001
Mackenzie Delta, Northwest Territories	50 780	800 m	200 m	2002
Southern New Brunswick	26 800	200 m	100 m	2002
Brazil	4500	100 m	30 m	2001

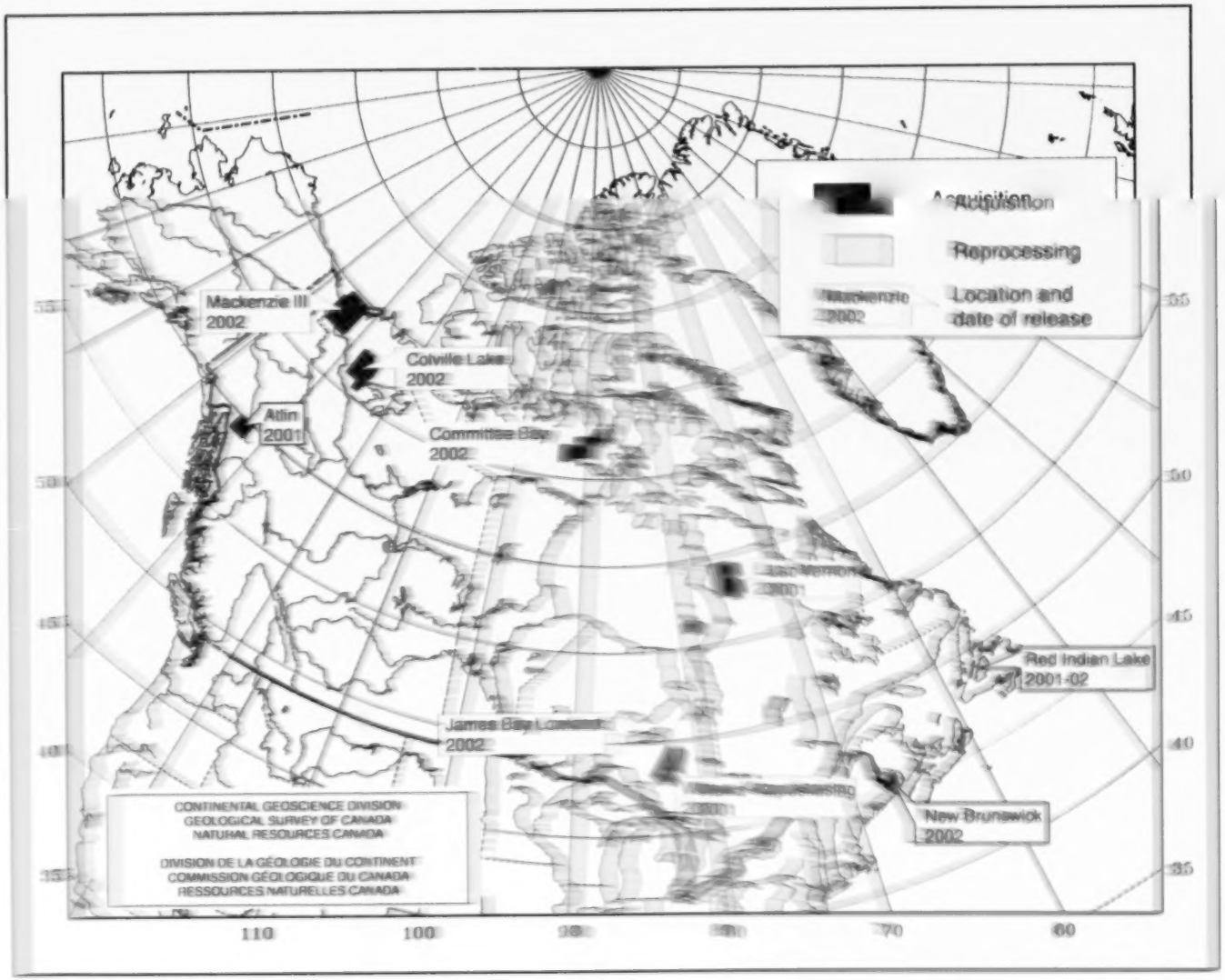

Figure 1. *GSC aeromagnetic survey and reprocessing projects in 2001–2002.*

2001a) contain total-field magnetic maps at a scale of 1:50 000 and open files 4057 to 4081 (Dumont et al., 2001b) contain first vertical derivative of magnetic field with Keating coefficients maps at a scale of 1:50 000 (each open file consists of 1 map sheet).

SURVEYS COMPLETED IN 2001

British Columbia

During the fall of 2001, the GSC conducted a regional aeromagnetic survey over the Atlin, British Columbia map area (NTS 104 N), located just south of the Yukon border. No publicly available aeromagnetic data existed for this area and the new survey data will be used to identify prospective mineral anomalies. The survey was conducted under the Targeted Geoscience Initiative, a federal program to promote mining investment within Canada. The survey was carried out by Sial Geosciences Inc. of St-Laurent, and covered 30 735 line-kilometres. The survey results were released to the public in October 2001 as Open Files 4071 to 4104 (Dumont et al., 2001c). Each open file consisted of one aeromagnetic total field map at a scale of 1:50 000.

Nunavut

The GSC conducted a detailed aeromagnetic survey over the Committee Bay greenstone belt in central Nunavut (NTS 56 I, J, O and P). The survey was conducted under the Targeted Geoscience Initiative and the flying was completed in 2001. The area was identified by Nunavut as its highest priority for geoscience studies in support of sustainable development. The results should stimulate mineral exploration and will replace thirty-year-old regional data with double the line density, lower altitude, and optimally directed (across-strike) coverage. The survey was carried out by Sander Geophysics Limited of Ottawa and covered 85 300 line-kilometres. The survey results will be released to the public in the spring of 2002.

Quebec

During 2000–2001, the GSC undertook a detailed aeromagnetic survey over the Lac Vernon area of Quebec (NTS 34 J and part of 34 G). In the spring of 2001, the survey was extended beyond the original northern boundary to cover the southern half of NTS 34-O. This survey complements and expands the extensive geological mapping and geochemistry program conducted by the Quebec Ministry of Natural Resources (MRNQ). MRNQ is examining the mineral potential of this northeast sector of the Superior Province, focusing on the Fe, Zn, Au content of several volcanic-sedimentary belts and the potential for diamondiferous kimberlites. The survey was completed under the Targeted Geoscience Initiative program and was carried out by Sial Geosciences Inc. of St-Laurent, Quebec. The survey results were released to the public in October 2001 as Open Files 4082 to 4106 (Dumont et al., 2001d).

UPCOMING SURVEYS

New Brunswick

In September 2001, Fugro-Sial Airborne Surveys Inc. of St-Laurent was awarded a contract to conduct a high-sensitivity aeromagnetic survey over southern New Brunswick. Approximately 26 800 line-kilometres will be acquired over map sheets NTS 21 G/02, 03, 06, 07, and 10 with the New Brunswick Department of Natural Resources and Energy (DNRE) providing the funding. The GSC will monitor the preflight calibrations, in-field acquisition procedures, compilation routines, and will inspect the final deliverables. The survey results will be released to the public in the spring of 2002.

REPROCESSING

Ontario

In collaboration with the OGS, the GSC recompiled, under contract, older industry data in northern Ontario. In October 2000, Scott Hogg & Associates were contracted by the GSC to reprocess the pre-existing data set. The survey flown in 1960, covered the James Bay Lowlands (parts of NTS 42 I and 42 P). The data were originally compiled at a scale of 1:250 000 and digitized at 500 m line spacing. The digitized data, flight-line plots of these maps, together with a recovered digital profile database divided into twelve subsets, provided the starting point for the reprocessing. The principal reprocessing tasks were the visual transfer of plotted fiducials from the original mosaics to an orthophoto base; the reconstruction of a single comprehensive profile database; the levelling of the aeromagnetic profiles; and the preparation of gridded data files. A total of 19 954 picked points were identified and transferred, and 988 traverse lines and 14 control lines, comprising 37 067 line-kilometres were compiled and levelled.

Newfoundland

Recompilation of airborne magnetic and electromagnetic geophysical data over the 'Red Indian Line' area of central Newfoundland was funded as part of the national Targeted Geoscience Initiative to stimulate mineral exploration. The Government of Newfoundland and Labrador (GNL) supplied detailed survey data from their assessment files and the Geological Survey of Canada (GSC) contributed regional data plus their expertise for processing and compiling the data.

The objective of this geophysical recompilation is to make available to the public previously unpublished private-sector data from GNL and to present it in the context of the regional magnetic coverage. These private sector surveys

A CD-ROM containing the airborne geophysics compilation (Part I) was jointly released with the Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey in September 2001. A second release (Part II) is scheduled for spring 2002.

INTERNATIONAL

Brazil

Three, small, helicopter electromagnetic (HEM)/magnetic/VLF-EM pilot-project surveys, totalling some 4 500 line-kilometres covering 340 km^2, were carried out in northeastern Brazil under a joint CIDA (Canadian International Development Agency)/Brazil Groundwater Project. This technology-transfer program was designed to enhance the capacity of Brazilian institutions in the area of groundwater exploration and management. The surveys were carried out in the states of Rio Grande do Norte (Serrinha area, 100 km^2), Pernambuco (Samambaia area, 100km^2), and Ceará (Irauçuba (tst area, 140km^2) all of which are drought-prone. These particular surveys were used to test the ability of airborne electromagnetic methods to map water bearing fractures and to improve the success rate of drilling high yielding wells. The groundwater in the crystalline bedrock of northeastern Brazil is slightly brackish, and, because of this condition, it was expected that water-filled fractures would respond as conductors in an induced electromagnetic field. Preliminary results show that HEM does have great potential as a groundwater-mapping tool in northeastern Brazil. The data will be published in the fall of 2001.

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2001a: *High-resolution aeromagnetic data, Northern Ontario, parts of NTS 42 B, G, O — total field magnetic maps*. Geological Survey of Canada, Open Files 4029 to 4056, scale 1:50 000, 28 open files.

2000b: *High-resolution aeromagnetic data, Northern Ontario, parts of NTS 42 B, G, O — First vertical derivative of magnetic field with Keating coefficients maps*. Geological Survey of Canada, Open Files 4057 to 4084, scale 1:50 000, 28 open files.

2001c: *Aeromagnetic total field map, NTS 104 N, British Columbia*; Geological Survey of Canada, Open Files 4081 to 4106, scale 1:50 000, 26 open files.

2000d: *Aeromagnetic total field map, Quebec*; Geological Survey of Canada, Open Files 4126 to 4158, scale 1:50 000, 33 open files.

Geological Survey of Canada Project numbers 000021, 000030, 000113, 000177, 000217, 000231, 000278